

return to its original configuration). In other words, we cannot suppose energy to be conserved unless we connect the new forces by some fixed laws with known and already determinate physical agents, and we must be content to regard the system as non-conservative until the necessary physical connection is assigned and introduced which will account for the free forces that we have observed, and will allow us to comprehend their action under the known laws of inanimate natural agency. This way of dealing with the work of "external forces" on a system which the new science of energy has devised, and shown to be the only one which in these cases can be generally employed, has perhaps contributed (but only by the unavoidable abstruseness and abstractness which belong to the new science itself) to invest with something of the appearance of a "phantom" and with an air of mystery, the character of force, and the laws of its operation as they have been universally studied in mechanics. But rightly regarded according to the simple principles of philosophical consistency and progress, which the new science of energy recognises in its probable extensions, there can be no doubt that it will really tend to establish more clearly than before the familiar notions of mechanics, and to open out fields of application of the time-honoured laws of motion and of force in unforeseen directions, in which their certainty and truth will continue to be felt as surely and to be described as simply now and hereafter, as they were in the days of Galileo and of Newton.

Newcastle-on-Tyne

A. S. HERSCHEL

Faraday's "Experimental Researches"

MR. SILVANUS P. THOMPSON, of Bristol, has made, in NATURE (vol. xvii. p. 304) an inexplicable attack upon my issue of Faraday's "Experimental Researches in Electricity," 3 vols. 8vo. 1839-55, unwarranted by logic or facts.

Mr. Thompson ordered my issue, which is advertised as "a perfect copy" of Faraday's work, through a Bristol bookseller, to whom it was charged at the trade price of 36s. Mr. Thompson declined to ratify his purchase, and there the matter should have ended, as I would readily have cancelled the transaction with his agent.

Mr. Thompson says that I profess to supply a perfect copy of Faraday's "Experimental Researches," implying that my professions are deceitful. I am at a loss to understand his meaning, because the fact is that I can and do supply perfect copies.

The history of the book is as follows:—Faraday's "Experimental Researches," 3 vols., appeared in 1839-55, in 3 vols. 8vo, with plates, and in course of time two of the volumes fell out of print, which raised the market value of occasional copies to seven and eight guineas. Availing myself of the opportunity of buying from Mrs. Faraday the copyright and existing stock, I completed, by facsimile reprint, a small number of copies, as is plainly stated on the title-pages of vols. 1 and 2. I alone possess the right to reprint the whole or a portion of the work.

It was at Mrs. Faraday's express wish that only such a reprint has been executed, and I was further advised to that course by eminent Fellows of the Royal Society. Mr. Thompson's innuendo of wilful deception is an infamous slander unworthy of a man of science.

I consider I deserve the thanks of all purchasers of Faraday's "Researches" for having invested my capital in the long dormant copyright of this work, and having thus put it in the power of students to obtain "perfect copies" at a moderate price.

Messrs. Taylor and Francis, the printers of the former edition, executed for me the reprint of the first two volumes (the stock of the original third volume not having been exhausted.) The original dates were preserved to show that no alterations had been made, and to preclude the notion, which Mrs. Faraday desired to avoid, that she had sanctioned a veritable new edition.

After this explanation I do not doubt that Mr. Thompson will see he has deceived himself, and I expect that he will apologise for his ill-advised attack upon my genuine and authorised re-issue, and admit that it is indeed a perfect copy of Faraday's great work.

BERNARD QUARITCH

Singing in the Ears

THIS consists of two or more continuous or alternating tones originating within the ear, very faint and sounding like a tea-kettle just beginning to boil, or a distant orchestra tuning. It is heard when there is undue pressure of the circulation in the head, as after long mental application, or upon hanging the head downwards. To my ear these tones bear constant musical relations to each other, and as the phenomenon bears directly on

the theory of the mechanism of audition, its verification is a matter of importance.

Will the readers of NATURE who can observe it write me what are the intervals of pitch (i.e. thirds, fourths, octaves, fifths, &c.) between the different tones heard together or alternating?

XENOS CLARK

916, Washington Street, San Francisco, Cal.

Meteor

ABOUT 12.47 A.M. (Irish time) on Monday the 18th inst., I observed a brilliant meteor when looking north from the south side of Dublin. It resembled a bluish white ball with an apparent diameter of about one-fifth that of the moon, which was shining brightly at the time, and left behind it a continuous yellowish luminous train. When first sighted it appeared at an angular distance of about 15° from the polar star, and appeared to be in the constellation of the Dragon, about midway between the brilliant star of the constellation of Lyra and the polar star, somewhat below the line joining these constellations.

Its path was apparently a line about 5° from the vertical, and inclined from west towards east, and I lost sight of it when at an angle of 10° with the horizon by intervening buildings. Its brilliancy surpassed that of the moon, which at the time was bright enough to allow of distinguishing printed characters. It did not burst while in sight, and I heard no report.

Royal College of Science, Dublin

H. HATFIELD

Eucalyptus

I have only just observed Dr. Calmy's letter in your impression of the 7th inst. (p. 283). The febrile attacks to which I alluded in NATURE (vol. xvii. p. 10) were sufficiently serious to incapacitate shepherds and stockmen for anything like continuous work for two or three weeks, and on some days the men were quite prostrated. The mosquito of which I spoke as not being banished by the presence of Eucalyptus is that species of Culex whose larval state is passed in water (the larvæ may even be seen in rain-water collected in decayed parts of trees), and I cannot call to mind a single place from which these pests were absent, trees being present. No doubt they may be carried many miles by the wind from their place of birth; but the real question is whether any species of gum so drains the land as to banish both mosquito and malaria by drying wet soil. If so, how is it that we find in Australia swamps which have existed for apparently an indefinite time, and do not look in the least likely to dry up, though the "blue" gum grows all round them, where the mosquito is rampant and malarious fever not by any means rare? I entirely agree with Dr. Calmy that the mosquito may be a "real danger to the rash traveller." One not acclimatised would suffer agonies among the mangrove swamps of Moreton Bay. I have had my own hands so paralysed by the poison that I could not close them without difficulty; and a new arrival, whom I took there on a duck-shooting expedition, was almost blinded, and became seriously ill for some days, though he was exposed to the attacks of the insects only a few hours. Whatever may be the case in Algeria or the Campagna, no one familiar with Australia will give the gum-trees there credit for having banished swamps, malaria, or mosquitos. Is not the Newfoundland mosquito of the pine forests to which Dr. Calmy alludes bred in water?

ARTHUR NICOLS

February 20

Telephone Experiments

THE following experiments with the ordinary small portable telephone may interest your readers.

Experiment 1. Connect a small strip of zinc by a thin covered wire to one of the binding screws of the instrument, and connect in the same way to the other binding screw a plate of metal with a rough edge; a saw does well. Place the end of the piece of zinc in the mouth, or hold it between moist fingers. Take a shilling between the fingers of the other hand and pass it along the teeth of the saw. The sound is clearly heard in the telephone. If instead of a shilling, a sovereign or a penny be used, the result is much the same, but if a piece of zinc be substituted, the sound in the telephone, if not lost, becomes very feeble.

Experiment 2. With the apparatus as before, let a number of persons, taking hand in hand, form a chain. At one end of this chain the zinc is held, and at the other the shilling. When the saw is rubbed the sound is heard in the telephone so long as the hands are held, but on leaving go anywhere in the chain the telephone becomes silent. This experiment is successful with

eight persons, and no doubt would be with a larger number. The hands should be moistened.

These experiments show in a simple and striking way that in the telephone we have an instrument which is sensitive to very minute electric impulses.

W. CARPMAEL

24, Southampton Buildings, W.C.

ELIAS MAGNUS FRIES

BY the death of Fries, Sweden has lost one more of the line of eminent botanists whose labours have thrown a lustre so great upon Scandinavian science. Well versed in all domains of phanerogamic botany, and especially skilled in his native plants, it was amongst the cryptogams he spent the more active years of his long life. While lichenology owes to him valuable illustrations, fungology received at his hands a large element of its construction. In the acquisition, description, and systematic arrangement of the larger fungi he exhibited a zeal, a tact, and a perspicuity which seem to have left comparatively little to be done in later times, either by way of addition or improvement.

Elias Magnus Fries was born in Småland on August 15, 1794. His father, pastor of the church at Femsjö, was an ardent and accomplished botanist. As there were no boys of his own age whom the young Fries could make companions, he constantly accompanied his father in his walks, and was in his earliest years made intimate with all the flowering plants of a district diversified by forest, mountain, marsh, and river. About the age of twelve he lighted upon an especially brilliant *Hydnum*, and was then first incited to the study of the Agarics and their allies, that abound in his native land more than in any other region of Europe. Before he left his school at Wexjö he knew, and had given temporary names to, nearly 400 species. In 1811 he entered the University of Lund, where he had Schwartz, Agardh, and Rezius as his teachers; and in 1814 was chosen Docent of Botany. In this year he published his "*Novitiæ Floræ Suecicæ*," first part, the second part following in 1823. In 1815 appeared his "*Observationes Mycologicæ*," the first important result of his fungological researches. In the following year, dissatisfied with the method of Persoon, he began to construct an entirely new system. As a first fruit he wrote his "*Specimen Systematis Mycologicæ*," a tract of a few pages, and, in outline, his great work the "*Systema Mycologicum*," the first volume of which appeared in 1821 and the last in 1829. In 1825 he sent forth the "*Systema Orbis Vegetabilis*," first part, a work not further completed, and in 1828 the "*Elenchus Fungorum*," a commentary on the *Systema*. In 1831 was published "*Lichenographia Europæa Reformata*," and in 1838 his second great work, the "*Epicrisis Systematis Mycologici*." About this time he completed the manuscript of a "*Synopsis Ascomycetum*," in which he had included upwards of 600 new species. Owing to his impatience of the critiques of Corda, Kunze, and the German fungologists who had begun to avail themselves of the new aid of the perfected microscope, an assistance which Fries denied himself, he refrained from publishing it, but one may hope this valuable MS. may still exist. In 1834 he was made Professor of Practical Economy at Upsala, from which place he gave out the "*Flora Scanica*." He was sent to the Rigsdag in 1844 and 1848 as representative of his university, and was made a member of the Swedish Royal Academy in 1847. In 1851 he succeeded to the chair of Botany at Upsal, vacated by Wahlenberg, which he resigned only a few years before his death to his son. In 1846 he published the "*Summa Vegetabilium Scandinaviæ*," and in 1860, "*Sveriges ätliga och giftiga Svampar*," with fine coloured plates. A project of the Royal Society of Holm to publish at its expense drawings of all species of Hymenomycetes under Fries's direction, induced him to write a third and

fuller description of the Agarics, of which he printed only 100 copies, under the title of "*Monographia Hymenomycetum Suecicæ*," in 1863. The first fasciculus, however, of the corresponding "*Icones*," appeared only in 1867; a second volume was commenced towards the end of last year. Fries lived at Upsal all the latter years of his life, in good health, and in constant correspondence with the botanists of this and other countries, taking, so far as his age permitted, all his early interest in his favourite Agarics. Thus he published, in 1874, a second edition of his "*Epicrisis*," including in it all the later found European species.

He died, after a short illness, on the 8th inst.

THE TELEPHONE, AN INSTRUMENT OF PRECISION

THE applications to which the telephone may in future be put cannot yet be all foreseen. I have to-day had its value shown to me in a remarkable way. 1. I used a thermo-electric intermittent current by drawing a hot end of copper wire along a rasp completing the circuit. A telephone was put into the circuit, in another room, and every time that the wire was drawn along the rasp a hoarse croaking was heard in the telephone. 2. I used a thermopile with a Bunsen burner shining on it from a distance of six feet. The current was rendered intermittent by the file, and the sound was most distinctly heard. A Thomson's reflecting galvanometer was introduced into the circuit which showed that the currents were extremely small. 3. The feeblest attainable currents were now tried. The thermopile was removed, and without any artificial application of heat it was shown by the galvanometer that the natural differences in the temperatures of the different junctions in the circuit were sufficient to generate feeble electric currents only just perceptible with the mirror galvanometer. These were easily detected by aid of the rasp and the telephone. Even when contact was simply made and broken with the hand, a click was heard in the telephone. 4. Lastly, these feeble currents were rendered still more insignificant by passing them through the body of a friend who held one end of the wire in each hand, and still the effects were faintly audible. Here the galvanometer, which was still in circuit, hardly gave any indication.

I have now added the telephone to the list of apparatus in the laboratory, considering it to be perhaps the most delicate test of an electric current which we possess.

In these experiments only one telephone is used, viz., at the receiving end. Employed in this way with a powerful current sent from the other end of the line, we may hope to have messages sent through submarine cables much more rapidly than at present. Probably it will be best to have the intermittent nature of the current maintained by an induction-coil, or by a spring rubbing against a continuously rotating cog-wheel, when the current is allowed to pass only when required by the depression of a key which communicates to the listener at the receiving end the long and short dashes of the Morse alphabet.

I ought to mention that I believe the person who first used a thermo-electric current with a telephone was Prof. Tait.

GEORGE FORBES

Andersonian College, Glasgow, February 13

OUR ASTRONOMICAL COLUMN

LOHRMANN'S LUNAR CHARTS.—At last astronomers are put in possession of the charts of the moon's surface, commenced by W. G. Lohrmann, of Dresden, in 1821. They are now completed in twenty-five sections; but previously only one part, containing four topographical sections, had been published. This was issued at Leipzig in 1824; a small general chart was lithographed at Dresden at a later period. It is through the active